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| EXAMINER | |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## DETAILED ACTION

### *Response to Amendment*

1. By way of the amendment filed 6/9/2009: claims 1 and 9 are amended. The amendments of 6/9/2009 will be entered into the record.

### *Claim Rejections - 35 USC § 103*

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 1-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumamura et al (U.S. Patent 5,102,587, already of record, herein after referred to as Kumamura), in view of Bulgrin et al (From previous Office Action, herein after referred to as Bulgrin). Regarding claim 1, Kumamura teaches:

5. Detecting an angular velocity $\omega$ of a motor operative to propel forward a screw in an injection molding machine

6. [Determining] an estimated melt pressure value $\delta$^ without deriving a differential of the detected angular velocity $\omega$ based on an observer, from said detected angular velocity $\omega$ of said motor and a torque command value $T^{CMD}$ given to said motor

7. Controlling said motor such that said estimated melt pressure value $\delta$^ follows a melt pressure setting $\delta^{REF}$

8. Wherein the observer is denoted as an equation for obtaining an estimated value of a state variable by solving a differential equation expressed to estimate a state variable such that a control target coincides with a model output

9. Kumamura teaches a method of controlling the injection pressure in an electric injection molding machine (Figure 8 and column 12 lines 34-68 through column 14 lines 1-41) by using the same variables and methods as laid out in claim 1. However Kumamura only teaches determining/detecting and controlling the estimated melt pressure, not deriving the estimated melt pressure, and does not teach an observer.

10. In the same field of endeavor Bulgrin teaches mathematically deriving an estimated melt pressure, as discussed in the previous Office Action. Also, Bulgrin teaches arithmetic observers (paragraph 0021 and page 12, claim 4: as pointed out in the previous Office Action). Regarding the observer being gained from a differential equation with state variables see paragraphs 0019 and 0021. Though not explicitly stated, the observer could be obtained form the solution of the differential equations used by Bulgrin in paragraph 0019. The Examiner would like to note that Bulgrin does teach using the derivative of the angular velocity in the estimated melt pressure calculation.

11. Be that as it may, it would have been obvious to one having ordinary skill in the art at the time the invention was made to be able to apply mathematical formulations, per Bulgrin, using the variables and detection methods as taught by Kumamura to

derive an estimated melt pressure without taking the derivative of the angular velocity. Since doing so would improve the process capabilities of injection molding machines (Bulgrin, paragraph 0016).

12. Regarding claim 2, Bulgrin, for the previously stated reason, teaches:

13. Wherein said observer is represented by the following Expression 1 (Expression 1 not shown)

14. $\omega$^ : Estimated value of Angular velocity of Motor

15. Bulgrin et al disclose a means for detecting angular velocity (Figure 8a)

16. $d_1$, $d_2$ : Certain coefficients (Figure 8a)

17. J: Inertia moment over Injection mechanism (paragraph 0060)

18. $F(\omega)$ : Dynamic frictional resistance and Static frictional resistance over injection mechanism

19. Dynamic frictional resistance and Static frictional resistance are defined as a function of torque and velocity, both of which Bulgrin et al disclose (page 12, claim 4)

20. Bulgrin et al disclose the claimed invention except for Expression 1 (symbolic of a value of a result effective variable). It would have been obvious to one having ordinary skill in the art at the time the invention was made to develop Expression 1 using the known variables, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to develop Expression 1 using the known variables, which are well within the level of ordinary skill in the art, for the purpose of controlling the injection pressure to

ensure that the injection process is free of defects. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

21. Regarding claim 3, Bulgrin, for the previously stated reason, teaches:

22. Wherein said observer is represented by the following Expression 2 (Expression 2 not shown)

23. $\omega$^ : Estimated value of Angular velocity of Motor

24. Bulgrin et al disclose a means for detecting angular velocity (Figure 8a)

25. $d_1$, $d_2$ : Certain coefficients (Figure 8a)

26. J: Inertia moment over Injection mechanism (paragraph 0060)

27. $F(\omega)$ : Dynamic frictional resistance and Static frictional resistance over injection mechanism

28. Dynamic frictional resistance and Static frictional resistance are defined as a function of torque and velocity, both of which Bulgrin et al disclose (page 12, claim 4)

29. $x_{-1}$ : Value of x at Immediately preceding processing period

30. These values would be known since these are well within the level of ordinary skill in the art and there are means for the detection of these values as described above.

31. Bulgrin et al disclose the claimed invention except for Expression 2. It would have been obvious to one having ordinary skill in the art at the time the invention was made to develop Expression 2 using the known variables, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to develop Expression 2 using the known

variables for the purpose of controlling the injection pressure to ensure that the injection process is free of defects. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

32. Regarding claim 4, Bulgrin, for the previously stated reason, teaches:

33. Wherein said screw in said injection molding machine and said motor are coupled together via a belt suspended around pulleys mounted on respective rotation shafts (Figure 2 and 5), and wherein said observer is represented by the following Expression 3 (Expression 3 not shown)

34. $d_1$ - $d_5$ : Certain coefficients (Figure 8a)

35. $J^M$ : Inertia moment at Motor side (paragraph 0060)

36. $\omega^M$ :angular velocity of Motor (paragraph 0060)

37. $R^M$ :Pulley radius at Motor side (This would be a known variable of the injection molding machine: Figure 6)

38. F : Tension of Belt (This would be a known variable of the injection molding machine: Figure 6)

39. $K_b$ : Spring constant of Belt (This would be a known variable of the injection molding machine: Figure 6)

40. $J^L$ : Inertia moment at Screw side (paragraph 0060)

41. $\omega^L$ : Angular velocity at Screw side (paragraph 0060)

42. $R^L$ : Pulley radius at Screw side (This would be a known variable of the injection molding machine: Figure 5)

43. $Fd(\omega^L)$ : Dynamic frictional resistance at Screw side

44. Dynamic frictional resistance is defined as a function of torque and velocity, both of which Bulgrin et al disclose (paragraph 0060)

45. $K_w$ : Elastic modulus of Resin (This is a known variable of the material being injected)

46. $K_{wd}$ : Coefficient of Viscosity of Resin (This is a known variable of the material being injected)

47. $\sigma$: Force of Screw pushing Resin (paragraph 0061)

48. Bulgrin et al disclose the claimed invention except for Expression 3. It would have been obvious to one having ordinary skill in the art at the time the invention was made to develop Expression 3 using the known variables, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to develop Expression 3 using the known variables for the purpose of controlling the injection pressure to ensure that the injection process is free of defects. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

49. Regarding claim 5, Bulgrin, for the previously stated reason, teaches:

50. Wherein said screw in said injection molding machine and said motor are coupled together via a belt suspended around pulleys mounted on respective rotation shafts (Figure 2 and 5), and wherein said observer is represented by the following Expression 4 (Expression 4 not shown)

51. $d_1$ - $d_5$ : Certain coefficients (Figure 8a)

52. $J^M$ : Inertia moment at Motor side (paragraph 0060)

53. $\omega^M$ :angular velocity of Motor (paragraph 0060)

54. $R^M$ :Pulley radius at Motor side (This would be a known variable of the injection molding machine: Figure 6)

55. F : Tension of Belt (This would be a known variable of the injection molding machine: Figure 6)

56. $K_b$ : Spring constant of Belt (This would be a known variable of the injection molding machine: Figure 6)

57. $J^L$ : Inertia moment at Screw side (paragraph 0060)

58. $\omega^L$ : Angular velocity at Screw side (paragraph 0060)

59. $R^L$ : Pulley radius at Screw side (This would be a known variable of the injection molding machine: Figure 5)

60. $Fd(\omega^L)$ : Dynamic frictional resistance at Screw side

61. Dynamic frictional resistance is defined as a function of torque and velocity, both of which Bulgrin et al disclose (paragraph 0060)

62. $x_{-1}$ : Value of x at Immediately preceding processing period

63. These values would be known since there are means for the detection of these values as described above.

64. Bulgrin et al disclose the claimed invention except for Expression 4. It would have been obvious to one having ordinary skill in the art at the time the invention was made to develop Expression 4 using the known variables, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to develop Expression 4 using the known

variables for the purpose of controlling the injection pressure to ensure that the injection process is free of defects. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

65. Regarding claim 6, Bulgrin, for the previously stated reason, teaches:

66. Wherein said screw in said injection molding machine and said motor are coupled together via a belt suspended around pulleys mounted on respective rotation shafts (Figure 2 and 5), and wherein said observer is represented by the following Expression 5 (Expression 5 not shown)

67. $d_1 - d_4$ : Certain coefficients (Figure 8a)

68. $J^M$ : Inertia moment at Motor side (paragraph 0060)

69. $\omega^M$ :angular velocity of Motor (paragraph 0060)

70. $R^M$ :Pulley radius at Motor side (This would be a known variable of the injection molding machine: Figure 6)

71. F : Tension of Belt (This would be a known variable of the injection molding machine: Figure 6)

72. $K_b$ : Spring constant of Belt (This would be a known variable of the injection molding machine: Figure 6)

73. $J^L$ : Inertia moment at Screw side (paragraph 0060)

74. $\omega^L$ : Angular velocity at Screw side (paragraph 0060)

75. $R^L$ : Pulley radius at Screw side (This would be a known variable of the injection molding machine: Figure 5)

76. $Fd(\omega^L)$ : Dynamic frictional resistance at Screw side

77. Dynamic frictional resistance is defined as a function of torque and velocity, both of which Bulgrin et al disclose (paragraph 0060)

78. Bulgrin et al disclose the claimed invention except for Expression 5. It would have been obvious to one having ordinary skill in the art at the time the invention was made to develop Expression 5 using the known variables, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to develop Expression 5 using the known variables for the purpose of controlling the injection pressure to ensure that the injection process is free of defects. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

79. Regarding claim 7, Bulgrin, for the previously stated reason, teaches:

80. Wherein said screw in said injection molding machine and said motor are coupled together via a belt suspended around pulleys mounted on respective rotation shafts (Figure 2 and 5), and wherein said observer is represented by the following Expression 6 (Expression 6 not shown)

81. $d_1 - d_4$ : Certain coefficients (Figure 8a)

82. $J^M$ : Inertia moment at Motor side (paragraph 0060)

83. $\omega^M$ :angular velocity of Motor (paragraph 0060)

84. $R^M$ :Pulley radius at Motor side (This would be a known variable of the injection molding machine: Figure 6)

85. F : Tension of Belt (This would be a known variable of the injection molding machine: Figure 6)

86. $K_b$ : Spring constant of Belt (This would be a known variable of the injection molding machine: Figure 6)

87. $J^L$ : Inertia moment at Screw side (paragraph 0060)

88. $\omega^L$ : Angular velocity at Screw side (paragraph 0060)

89. $R^L$ : Pulley radius at Screw side (This would be a known variable of the injection molding machine: Figure 5)

90. $Fd(\omega^L)$ : Dynamic frictional resistance at Screw side

91. Dynamic frictional resistance is defined as a function of torque and velocity, both of which Bulgrin et al disclose (paragraph 0060)

92. $x_{-1}$ : Value of x at Immediately preceding processing period

93. These values would be known since there are means for the detection of these values as described above.

94. Bulgrin et al disclose the claimed invention except for Expression 6. It would have been obvious to one having ordinary skill in the art at the time the invention was made to develop Expression 6 using the known variables, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to develop Expression 6 using the known variables for the purpose of controlling the injection pressure to ensure that the injection process is free of defects. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

95. Regarding claim 8, Bulgrin, for the previously stated reason, teaches:

96. The method of controlling pressure in an electric injection molding machine according to claim 3, 5, or 7, further comprising: calculating said torque command value

$T^{CMD}$ for said motor based the following Expression 7 (Expression 7 not shown); and feeding back said torque command value to said motor. (paragraph 0021)

97. kp: Certain constant

98. $\alpha$ : Certain function or constant

99. Development of constants is well within the abilities of a skilled artisan.

100. Bulgrin et al disclose the claimed invention except for Expression 7. It would have been obvious to one having ordinary skill in the art at the time the invention was made to develop Expression 7 using the known variables, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to develop Expression 7 using the known variables for the purpose of controlling the injection pressure to ensure that the injection process is free of defects. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

101. Regarding claim 9:

102. An apparatus for controlling pressure in an electric injection molding machine, comprising: an observer arithmetic unit operative to derive an estimated melt pressure value $\delta$^ without deriving a differential of the detected angular velocity $\omega$, based on an observer, from an angular velocity $\omega$ of a motor operative to propel forward a screw in an injection molding machine and a torque command value $T^{CMD}$ given to said motor

103. And a torque arithmetic unit operative to calculate said torque command value $T^{CMD}$ for said motor using said estimated melt pressure value $\delta$^ derived at said observer arithmetic unit and feed back said torque command value to said motor

104. Wherein the observer is denoted as an equation for obtaining an estimated value of a state variable by solving a differential equation expressed to estimate a state variable such that a control target output coincides with a model output

105. Kumamura teaches the apparatus in Figure 8 and column 12 lines 34-68 through column 14 lines 1-41. However Kumamura does not use arithmetic units for the observer and torque.

106. In the same field of endeavor Bulgrin teaches arithmetic units for the observer (paragraph 0021 and page 12, claim 4) and torque (paragraph 0021). Regarding the observer being gained from a differential equation with state variables see paragraphs 0019 and 0021. Though not explicitly stated, the observer could be obtained form the solution of the differential equations used by Bulgrin in paragraph 0019. As discussed in the previous Office Action. The Examiner would like to note that Bulgrin does teach using the derivative of the angular velocity in the estimated melt pressure calculation.

107. Be that as it may, it would have been obvious to one having ordinary skill in the art at the time the invention was made to be able to apply arithmetic units, per Bulgrin, using the variables and detection methods as taught by Kumamura to derive an estimated melt pressure without taking the derivative of the angular velocity. Since doing so would improve the process capabilities of injection molding machines (Bulgrin, paragraph 0016).

108. Regarding claim 10, Bulgrin, for the previously stated reason, teaches:

109. The method of controlling pressure in an electric injection molding machine according to claim 1, further comprising deriving a dynamic frictional resistance $F(\omega)$

from a relation between a velocity or position and a torque or current value associated with said motor at the time of injection with no resin loaded.

110. Dynamic frictional resistance is defined as a function of torque and velocity, both of which Bulgrin et al disclose (paragraph 0060)

111. Bulgrin et al disclose the claimed invention except for a dynamic frictional resistance $F(\omega)$ function. It would have been obvious to one having ordinary skill in the art at the time the invention was made to develop a $F(\omega)$ function using the known variables, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to develop a $F(\omega)$ function using the known variables for the purpose of controlling the injection pressure to ensure that the injection process is free of defects. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

112. Regarding claim 11, Bulgrin, for the previously stated reason, teaches:

113. The method of controlling pressure in an electric injection molding machine according to claim 1, further comprising: defining a dynamic frictional resistance $F(\omega)$ as a sum of a velocity-dependent component and a load-dependent component; deriving said velocity-dependent component of said dynamic frictional resistance from a relation between a velocity or position and a torque or current value associated with said motor at the time of injection with no resin loaded; and deriving said load-dependent component of said dynamic frictional resistance from a relation between a torque or current value and a pressure value at the time of injection with a plugged nozzle

114. Dynamic frictional resistance is defined as a function of torque and velocity, both of which Bulgrin et al disclose (paragraph 0060)

115. Bulgrin et al disclose the claimed invention except for a dynamic frictional resistance $F(\omega)$ function. It would have been obvious to one having ordinary skill in the art at the time the invention was made to develop a $F(\omega)$ function using the known variables, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to develop a $F(\omega)$ function using the known variables for the purpose of controlling the injection pressure to ensure that the injection process is free of defects. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).*

***Response to Arguments***

116. Applicant's arguments filed 6/9/2009 have been fully considered but they are not persuasive.

117. As shown in this and the previous Office Actions Bulgrin teaches every variable need to control the melt pressure of an injection molding machine. It would have been obvious to create the needed equations from these variables by one having ordinary skill in the art.

118. Applicant's argument is that the observer used by the prior art lowers the resistance against the noise and can not control a precise melt pressure.

119. However if one looks at the use of the observer and the control of the melt pressure as taught by Bulgrin it clearly states in paragraph 0021:

120. The model and the observer, moreover, can account for non-linearities, noise, or other physical characteristics of the molding machine to provide a more accurate indication of the actual melt pressure than was possible using direct sensing techniques. For example, the melt pressure equation can take into account frictional forces associated with the translation of the injection ram. Thus, where a direct sensor cannot differentiate between such frictional forces and the actual melt pressure forces, the invention allows such forces to be subtracted or otherwise accounted for before rendering a melt pressure value.

121. The model and observer are further discussed in paragraphs 0019 and 0020.

122. Also as shown in paragraph 0-019 the model is created using one or more state equations (with state variables), where some are all may be differential equations. Then the observer is used to provide an estimate of the melt pressure using the model. Thus one having ordinary skill could calculate the observer using a differential equation.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TIMOTHY KENNEDY whose telephone number is (571) 270-7068. The examiner can normally be reached on Monday to Friday 9:00am to 6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Del Sole can be reached on (571) 272-1130. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

tjk

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